IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	David K. Benson et al.	**Examiner:**	**Keri** A. Moss
Serial No.:	091937,208	Group Art Unit:	1743
Filed:	05/28/2002		
For:	METHOD AND APPARATUS FOR **DETERMINING** DIFFUSIBLE HYDROGEN CONCENTRATIONS	Docket No.	**NREL** 99-03

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF RODNEY D. SMITH UNDER 37 CFR 1.132

1. My name is Rodney D. Smith, and I am one of the inventors in the above-referenced patent application.

2. I am making this Declaration to support the Amendment filed on May 29, 2007, in response to the examiner's February 27,2007, Office Action.

3. The specification, page 14, line 32, through page 15, lines 1 – 3, explain the empirical correlation of slopes of curves obtained from weld samples using the sensor assembly 20 to quantitative diffusible hydrogen concentrations using a standard method from the American Welding Society, i.e., AWS A4.3-93, for determining initial diffusible hydrogen concentrations from welded samples, including quenching within five seconds of extinguishing the arc and then agitating and storing the welded samples in ice water to hold the initial diffusible hydrogen in the samples until it can all be recovered by lab equipment and procedures. In our patent application specification, page 14, line 32, through page 15, lines 1 – 3, it is explained that the sensor response curves obtained with the sensor assembly 20 and that the quantitative results obtained from the AWS A4.3-93 lab analysis were from duplicate welded samples. Persons skilled in the art would readily understand that "duplicate welded sample" would mean weld

samples made with the same weld material with the same **welding** technique in the same conditions, including temperature.

4.   The specification, page 15, lines 3 – 18, also explains that theoretical curves can also be created with slopes that correlate closely with the experimental (empirical) response curves **from** the sampler assembly 20 by use of a theoretical **diffusion** equation based on a **form** of the error function to create theoretical **diffusivity** curves for various initial **diffusion** hydrogen concentration values, as explained in the specification, for use in matching slopes of such curves to actual measured hydrogen **diffusivity** rates as shown, for example, by Figure 4. Persons having ordinary skill in the metallurgy art know how to use the diffusion equation based on the error function to create **diffusivity** curves, as taught, for example, in Crank, J., The Mathematics of *Diffusion,* Oxford Science Publishing Co., 1992, p. 32; Skoog, D.A., and **Leary,** J.J., Principles of *Instrumental* Analysis, Saunders College Publishing Co., Fourth Edition, 1992, p. A – 17; and **Völkl,** J., and Alefeld, G., "Diffusion of Hydrogen in Metals," Hydrogen in Metals I, **Völkl,** J., and Alefeld, G., ed., Springer-Verlag, New York, 1978, pp. 321 – 348.

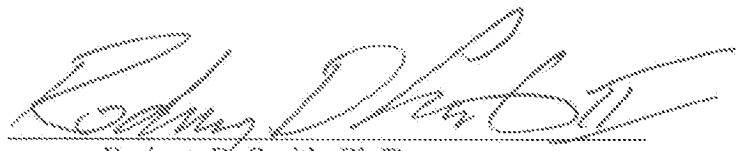5.   In paragraph 5 of the Office Action, the examiner also asserted the following:

> It would require undue experimentation for one of ordinary skill in the art to determine how to account for variations in temperature when calibrating the signal analyzer of the disclosed hydrogen sensor in accordance with the disclosure.

However, I respectfully disagree with that assertion. It is very straight forward for persons skilled in the art to follow the calibration explanations in the specification, pages 14 – 15 and 18 – 19, to calibrate the sensor assembly 20 to compensate for variations in output signal intensities due to temperature-dependent variations in light absorption by the tungsten oxide (WO_3) sensing layer 28. As explained in the specification, putting a known sample amount of hydrogen into the known sample chamber volume 18 provides a known hydrogen concentration in the sample volume 18, which causes a particular light absorption by the tungsten oxide (WO_3) sensing layer 28, thus a particular calibrated output

signal for such known hydrogen concentration in the sample volume 18 at that particular temperature of the tungsten oxide (WO_3) sensing layer 28. When such calibration measurement is done at the same temperature of the tungsten oxide (WO_3) sensing layer 28 as when the concentration of evolved hydrogen from a weld is measured with the tungsten oxide (WO_3) sensing layer 28, e.g., right after the measurement of the concentration of the evolved hydrogen from the weld is measured in the sample volume 18, then the known concentration output signal from the known hydrogen sample amount can be used to calibrate the output signal from the evolved hydrogen from the weld to the known calibration standard, as explained in the specification, which would be easy for persons skilled in the art.

6.   In paragraph 6 of the Office Action, the examiner noted that the specification, lines 16 – 19, mentions "known geometric and mass calculations" and then says "as will be described in more detail below", but such calculations were not actually shown in the specification. However, persons **skilled** in the art **will** understand that such "known geometric and mass calculations" for determining amount of material being sampled are essentially area and volume of a weld sample, which are junior high school level math, and the weld volume multiplied times density to get mass of the weld sample is a high school physics level calculation, which are well within the capabilities of persons skilled in the art. Therefore, it is not necessary to actually show such calculations in the specification for persons **skilled** in the art to understand how to do them.

7.   I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Rodney D. Smith, Ph.D.

Date: 5/31/07